

## **CHAPTER 5**

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### **REMOTE TERMINAL UNIT (RTU) - ELECTRONIC REPORTING**



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This chapter defines the tasks and characteristics for electronic reporting of emissions from all sources. The Facility Permit holder of a major source shall use an RTU to telecommunicate rule compliance data to the District Central Station Emissions Monitoring Computer. The RTU shall collect data, perform calculations, generate the appropriate data files, and transmit the data to the Central Station. The Facility Permit holder of a process unit may elect to use an RTU. Alternatively, the Facility Permit holder of a process unit shall compile the required rule compliance data manually, and transmit that data via modem in accordance with the data requirements of Section D in this chapter.

**A. GENERAL**

**1. General**

The Facility Permit holder of a major source shall telecommunicate rule compliance data to the District via Remote Terminal Units (RTU). This form of reporting may also be used for process units. The RTU shall collect data from a CEMS, a CPMS, or other equipment specified in the Facility Permit and send data periodically to the Central Station Emissions Monitoring Computer (Central Station).

This chapter specifies the tasks and characteristics required of the RTU and shall be used as a guide for providing the required software/hardware for the RTU. Emissions Data Collection System conformity as well as establishing and maintaining communications with the emission monitoring system and the Central Station shall be the responsibility of the Facility Permit holder. This chapter also serves as a functional guideline for operating requirements of the RTU, and provides information concerning RTU hardware/software procurement, configuration, installation, maintenance, and compatibility with the emission monitoring system and the Central Station.

**2. RTU and Supporting Equipment Description**

**a. Purpose:**

The RTU shall interface to existing data acquisition systems or other field instrumentation, and shall gather and store data, and facilitate telecommunication with the Central Station Computer.

**b. Environment:**

**i. Logical Environment:**

The signal chain includes the process equipment, sensing devices, data acquisition system, RTU, modem, communications link and District Central Station.

- ii. Physical Environment:  
Typical environments shall include "friendly" and "Central Station" environments. Friendly environments include clean, air conditioned areas such as computer rooms and offices. Hostile environments may include exterior spaces or interior spaces without benefit of air conditioning, and areas where free floating air particulates may impede the normal operation of exposed electronics. Each RTU shall be mounted in such a manner as to be environmentally qualified.
- iii. Electrical Environment:
  - 1) Connected Devices:  
Each RTU may receive information from a local computer (DAS) or various field sensing devices, calculate and/or store the specified parameters and shall make its data available to local and Central Stations.
  - 2) Sensor-based Data to be acquired:  
Where applicable, the RTU shall be able to directly monitor transducers which sense variables required for compliance determinations. At a minimum, input analog conversion hardware should operate with a medium level of resolution (i.e. 12 bit resolution) and a sampling rate sufficient to accurately characterize the sensor based data.
- iv. Description of Data to be transmitted:  
All data shall be made available at data output ports in ASCII format as described below:
  - 1) Data Sampling:  
Shall retain selectable status levels about its sensors.
  - 2) Rule-specific Data Sets:  
(as specified elsewhere)
- c. Functions:  
  
The RTU shall provide the following functions:
  - i. Power-Up/Restart Mode:  
Upon resumption of power after a loss, the RTU shall automatically restart and reset itself to predetermined system settings.
  - ii. Non-Communicating Mode:  
When in the non-communicating mode the RTU shall operate independently of the communications ports as well as store its transactions for later communications with the Central Station.

- iii. Failure Mode:  
In the event the RTU is unable to initiate communications with the Central Station, the RTU shall perform the following actions:
  - 1) The RTU shall first make four subsequent attempts to establish communications with the Central Station.
  - 2) Upon failure of the fourth attempt, the RTU shall:
    - a. Revert to the non-communicating mode for a period of fifteen (15) minutes and then again attempt to establish communications with the Central Station.
    - b. Each failure shall result in the execution of the failure mode sequence.
  - 3) Error Tolerance:  
The RTU shall perform its specified functions without misinterpretation of input information, errors in output signals, damage to internal components, and loss or change of stored information with either common mode to ground or differential mode transients present on the communication ports, circuits or power sources which shall be connected to the inputs and power supply terminals to the equipment.

## B. PRODUCTS

### 1. RTU Attributes

- a. *Environmental Tolerances:* Each RTU shall be installed in such a manner as to be environmentally qualified for the particular physical environment.
- b. *Communications Provisions:* The RTU shall provide a minimum of one (1) communications connection. The connection shall be labeled "Remote".
- c. *Real Time Clock:* The RTU shall be equipped with a battery-backed Real Time Calendar/Clock (RTC) to provide time signals for implementing time dependent programs. The battery back-up shall be field replaceable and shall not require replacement more often than once every two (2) years. An alarm message shall be generated when the battery reaches a low voltage point with at least one (1) month life under load left prior to the necessity for battery replacement.
- d. *Internal Software:*

- i. Data Collection and Storage: The RTU shall collect data from sensors, generate and store values, and perform calculations upon those values. Data shall be collected and stored in the Data Sampling memory.
  - ii. Calculations and Message Storage: Calculated values and messages resulting from calculations performed upon sampled data shall be stored as ASCII data strings in memory.
- e. *Security Provisions:*
  - i. Message Security: The RTU shall utilize a standard protocol encryption method for communications with the remote Central Station incorporating error detection. The system shall not incorporate error correction. The code shall detect one hundred (100) percent of single, double and triple errors; one hundred (100) percent of burst errors of six bits or fewer; ninety- seven (97) percent of all seven-bit bursts; and ninety-eight point four (98.4) percent of all other burst as well as a substantial fraction of all random error patterns involving more than three (3) bits.
  - ii. Message Checking: The RTU shall utilize bitsum checking for all messages.
- f. *Modem:* Provide a modem connected to the Remote Central Station communication port.
  - i. Modem Self-Test: The modem shall be capable of being operated in self testing mode automatically on a periodic basis.
- g. *Transient Suppression:* Provide hardware, circuitry, components or extended component ratings or characteristics necessary to prevent interference to correct operation or equipment damage from induced transients which may be presented on communication circuits and power sources. Transient suppression shall utilize the latest revision of the ANSI C37.90a standard.



**C. EXECUTION**

**1. General**

- a. Section (C) describes acceptable methods and practices for use in completion of this work.
- b. *Standards:* Perform the work in accordance with the latest revisions of the following standards:
  - i. ANSI American National Standards Institute.
  - ii. UL Underwriters Laboratories.
  - iii. EIA Electrical Industries Association.
  - iv. NEMA National Electrical Manufacturers Association.

**2. Project Plan**

Develop a project plan for accomplishing the requirements of this installation. The plan shall include a checklist for the Submittal date.

**3. Software Requirements Guideline**

The Software Requirement Guideline (SRG) shall specify tasks and characteristics required of the RTU and is to be used as a guide for providing the required software for the RTU. Emissions Data Collection System conformity as well as establishing and maintaining communications with the emission monitoring system and the Central Station shall be the responsibility of the Facility Permit holder.

- a. References

This guideline shall be used in conjunction with the following Rules:

**RULE 2011** - Requirements for Monitoring, Reporting and Recordkeeping for Oxides of Sulfur (SO<sub>x</sub>) Emissions

**RULE 2012** - Requirements for Monitoring, Reporting and Recordkeeping for Oxides of Nitrogen (NO<sub>x</sub>) Emissions

b. System Relation

The RTU shall be the local plant data storage and processing point in a system which is reporting data to a Central Station for evaluation to determine regulatory compliance. Data formats shall be standardized between the Central Station and all monitored emissions sources. It is the function of the RTU to convert as necessary the data stream from the local monitoring system. The fundamental operation of the RTU is to:

- i. compile information from the emission monitoring system as specified in this guideline.
- ii. transmit the compiled data to the Central Station on a scheduled basis.

c. Central Station Interface

On scheduled updates the RTU shall download current data to the Central Station. The RTU data buffer shall be reset after each successful download to the Central Station.

d. Software Responsibility

The Facility Permit holder shall be responsible for providing all RTU software required to perform all specified tasks. This may include purchased commercial software packages or custom written programs.

e. Product Function

i. Software Context and Data Flow Diagrams

The flow diagram at the end of this Chapter is a Context Diagram description and Data Flow Diagram which show how the different external functions tie to the RTU package. Plant data or operating information is collected by the emission monitoring system for evaluation of emissions. The RTU Unit is the process shown on this diagram and is the focus of this guideline.

Data Values relating to emissions received from the emission monitoring system are processed by the RTU into data files for transmission to the SCAQMD Central Station. The type of message is shown on the RTU Context Diagram between the RTU and the Central Station. The message is data sets which are sent periodically.

The RTU Data Flow Diagram is a graphical expansion of the RTU Unit process block. Emission monitoring system data is shown coming into the Network Driver and splitting to the other process blocks which represent RTU functions.

ii. Communication End Points

The RTU will communicate with both the emission monitoring system and the Central Station. Each end point has a different protocol and purpose. Data sent from the RTU to the Central Station shall be converted from floating point numbers used to perform calculations into ASCII standard to allow for different internal formats.

f. Specific Requirements

i. RTU Software

The main RTU program shall receive input data, do calculations (if necessary) and store all data in non-volatile memory, as it is received.

ii. Direct Field Input Data

Many RTUs may be capable of reading direct field inputs which shall consist of analog and/or digital real values. Direct field input requirements shall be specified as required for each RTU. Communications software shall be capable of supporting the hardware required to receive these inputs. If analog data cards must be installed in the RTU any resulting values provided to the RTU data bus shall range from -32768 to +32767 for unscaled values. The same accuracy as emission monitoring system network data shall be provided for analog data values scaled on the I/O device before going onto the RTU data bus.

iii. Input Data Conversion/Storage

All input values shall be stored in as received ASCII format. These values shall then be parsed and converted to real numbers for calculations and averaging.

iv. Output Data To Central Station

The context diagram displays how the RTU software shall be configured to allow messages to be sent to the Central Station. File transfer for all messages shall be in ASCII format including a bitsum check value with a return acknowledgment expected by the RTU when the Central Station has verified the bitsum check.

v. RTU To Central Station Communications Failure

If the RTU cannot communicate with the Central Station the main program shall store all calculated values and reports in a special file in non-volatile memory. These special files shall be labeled to show that they have not been acknowledged as received by the Central Station.

g. Performance Requirements

i. Speed of Receiving DATA

Incoming data from the plant or emission monitoring system shall be received at intervals specified in the appropriate emission monitoring guideline. Communication with the Central Station, Parsing, verification, storage and checking shall not block the receipt of new data.

ii. RTU Non-Volatile Memory

The RTU non-volatile memory shall have enough capacity to store all programs, data parameters, emission monitoring system input data and calculated data averages. Input data and calculated averages shall be allocated space using the first in first out (FIFO) method to store the quantity of data as required.

h. Design Restraints

i. Data Set Formats

Section (D) indicates the data format that is to be sent to the Central Station at scheduled intervals. The Central Station will send a confirmation message back for each transmission received which will consist of an identification number unique to the Central Station and a transaction number which is sequentially issued.

- i. RTU External Interface Requirements

- i. Central Station Interface

External interface to the RTU is shown on the Context Diagram at the end of this chapter. Central Station interface is described above as fixed format ASCII messages using a commercially available communication software package. In return the Central Station will send confirmation messages in ASCII form when a satisfactory message transfer has been completed.

#### 4. Required Installation Practices

- a. Standards: Install all devices in accordance with the standards set forth herein and in accordance with manufacturers recommendations and first class standard industry practice.

- b. Telephone Interface:

RTU shall operate on a standard analog telephone line. Label the remote Central Station communications connector with the telephone number to which it is connected.

#### 5. Submittals

- a. *Shop Drawing:*

- i. Submit two (2) copies of the following in accordance with the applicable rule compliance dates.

- o A Title Sheet
    - o Single Line Diagrams
    - o Wiring Diagrams or Run Sheets
    - o Physical Details of Custom Assemblies

- ii. Descriptions of the above shop drawings are as follows:

- a) Title Sheet containing a drawing list, abbreviations list, symbols list and schedules.
    - b) Single-Line Diagram for each system showing signal relationships of devices within the system and device nomenclatures.

- c) Wiring Diagram for each assembly or enclosure or free standing device, showing the following:
    - 1) the layout of the devices within;
    - 2) wiring connections;
    - 3) wire numbers;
    - 4) voltage levels, and
    - 5) fuse values and types.
  - d). Physical Details of contractor fabricated assemblies:
    - 1) Provide an assembly drawing showing the finished product. Show components comprising the assembly by manufacturer and model number.
    - 2) Provide a schematic diagram of the assembly, as described above.
- b. *RTU Components List:*
  - i. The RTU Component List shall contain the following information for all materials, components, devices, wire and equipment used:
    - o Quantity for that system.
    - o Description (generic).
    - o Manufacturers Name and Model number.
- c. *Software Design Description (SDD).* Indicate how the developed software will meet the defined software requirements. The SDD shall be based on ANSI/IEEE standards, specifically 1016 (SDD) and 730 (Quality Assurance).
- d. *Software Listing.* Provide a source code listing of all developed software required by the applicable emission monitoring requirements.

## D. DATA REQUIREMENTS

### 1. General Requirements

The District will accept data in the American Standard Code for Information Interchange (ASCII) format.

The data file structure must be sequential. The record delimiter - a ~ (tilde) occurs only once following the end of each data record. There must be no delimiter before the first data record. The ASCII value for the delimiter is:

~ (decimal 126)

Blank data records must not be reported

In text fields, only upper case characters are to be used and must be left justified. Text fields that are not applicable must be filled with blanks. The ~ character (decimal 126) must never appear inside text fields.

Numeric fields must be right justified and zero filled. Where decimal places are to be reported, they are to be implied - do not include the decimal point character. Numeric fields that are zeros or not applicable, must be zero filled.

Date fields must be entered in the format "YYYYMMDD" and must always specify a valid date.

### 2. Data File Description

A properly composed data file is comprised of the following data records (shown indented to illustrate the logical grouping):

Code 1A	- Transmitter Record
Code 1F	- Facility Record
	Emission data record(s) from any of the following data records
Code 1NP	- NO <sub>x</sub> Process Unit and Large Source Record
Code 1NM	- NO <sub>x</sub> Major Source Record
Code 1SP	- SO <sub>x</sub> Process Unit Record
Code 1SM	- SO <sub>x</sub> Major Source Record
Code 1FT	- Facility Total Record
Code 1F	- Facility Record
	Emission data record(s)
	.
	.
	.
Code 1FT	- Facility Total Record
Code 1T	- Final Total Record

The Code 1A data record identifies the facility submitting the data file and must be the first data record in the data file.

The Code 1T data record identifies the end of a data file and must be the last data record in the data file

The Code 1F data record identifies the facility whose emission data records are being reported.

The Code 1FT data record identifies the end of emission data records for a particular facility.

Code 1F/1FT data records must not be nested inside of another 1F/1FT group and are repeated for each facility to be reported.

Emission data records for a facility are reported following the Code 1F but before the 1FT data record for that facility and can comprise any of the following data record types:

Code 1NP	- NO <sub>x</sub> Process Unit and Large Source Record
Code 1NM	- NO <sub>x</sub> Major Source Record
Code 1SP	- SO <sub>x</sub> Process Unit Record
Code 1SM	- SO <sub>x</sub> Major Source Record



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### Code 1A - Transmitter Record

The Code 1A data record is used to identify the facility submitting the data file and must be the first data record reported.

Location	Field	Length	Description
1-4	Record Identifier	4	Constant "1A" followed by 2 blanks.
5-10 file.	SCAQMD Facility ID	6	Enter the 6-digit SCAQMD facility ID of the facility submitting the data

### Code 1F - Facility Record

The Code 1F data record is used to identify the facility whose emissions are being reported.

Location	Field	Length	Description
1-4	Record Identifier	4	Constant "1F" followed by 2 blanks.
5-10 are	SCAQMD Facility ID	6	Enter the 6-digit SCAQMD facility ID for the facility whose emissions being reported.

### Code 1FT - Facility Total Record

The Code 1FT data record is used to identify the end of data emission records for a facility.

Location	Field	Length	Description
1-4	Record Identifier	4	Constant "1FT" followed by 1 blank.
5-11 and zero fill.	Number of Emission Data Records	7	Enter the total number of emission data records reported for the facility (excluding the 1F and the 1FT data records). Right justify

### Code 1T - Final Total Record

The Code 1T data record is used to identify the end of the data file and must be the last data record reported.

Location	Field	Length	Description
1-4	Record Identifier	4	Constant "1T" followed by 2 blanks

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5-11 in the	Number of Data	7	Enter the total number of data records reported (including the Code 1T)  data file. Right justify and zero fill.
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### Code 1NP - NO<sub>x</sub> Process Unit and Large Source Record

The Code 1NP data record is used to report NO<sub>x</sub> emissions from NO<sub>x</sub> Process Units and Large Sources.

Location	Field	Length	Description
1-4	Record Identifier	4	Constant "1NP" followed by 1 blank
5-10 Left	SCAQMD Permit  Number	6	Enter the SCAQMD permit number for the equipment source.  justify and fill with blanks
11-18	Date Emitted	8	Enter the date emitted in the format "YYYYMMDD"
19-27 decimal	Total Emission	9 (#####.##)	Enter the total emission in lb to 2 decimal places. Omit the point, right justify and zero fill. No negative numbers.

### Code 1NM - NO<sub>x</sub> Major Source Record

The Code 1NM data record is used to report NO<sub>x</sub> emissions from Major NO<sub>x</sub> sources.

Location	Field	Length	Description
1-4	Record Identifier	4	Constant "1NM" followed by 1 blank
5-10	SCAQMD Permit Number	6	Enter the SCAQMD permit number for the equipment source. Left justify and fill with blanks.
11-18	Date Emitted	8	Enter the date emitted in the format "YYYYMMDD"
19-27 decimal	Total Emissions	9 (#####.##)	Enter the total emissions in lb to 2 decimal places. Omit the point, right justify and zero fill. No negative numbers.
28-33 Word	Status Word	6	Enter the six character status word for this hour from the Status Table.

### Code 1SP - SO<sub>x</sub> Process Unit Record

The Code 1SP data record is used to report SO<sub>x</sub> emissions from SO<sub>x</sub> Process Units.

Location	Field	Length	Description
1-4	Record Identifier	4	Constant "1SP" followed by 1 blank

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5-10	SCAQMD Permit Number	6	Enter the SCAQMD permit number for the equipment source. Left justify and fill with blanks.
11-18	Date Emitted	8	Enter the date emitted in the format "YYYYMMDD"
19-27 decimal	Total Emission	9 (#####.##)	Enter the total emission in lb to 2 decimal places. Omit the point, right justify and zero fill. No negative numbers.

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### Code 1SM - SOx Major Source Record

The Code 1SM data record is used to report SOx emissions from Major SOx sources.

Location	Field	Length	Description
1-4	Record Identifier	4	Constant "1SM" followed by 1 blank
5-10	SCAQMD Permit Number	6	Enter the SCAQMD permit number for the equipment source. Left justify and fill with blanks.
11-18	Date Emitted	8	Enter the date emitted in the format "YYYYMMDD"
19-27 decimal	Total Emissions	9 (#####.##)	Enter the total emissions in lb to 2 decimal places. Omit the point, right justify and zero fill. No negative numbers.
28-33 Word	Status Word	6	Enter the six character status word for this hour from the Status Table.

### Status Word Table

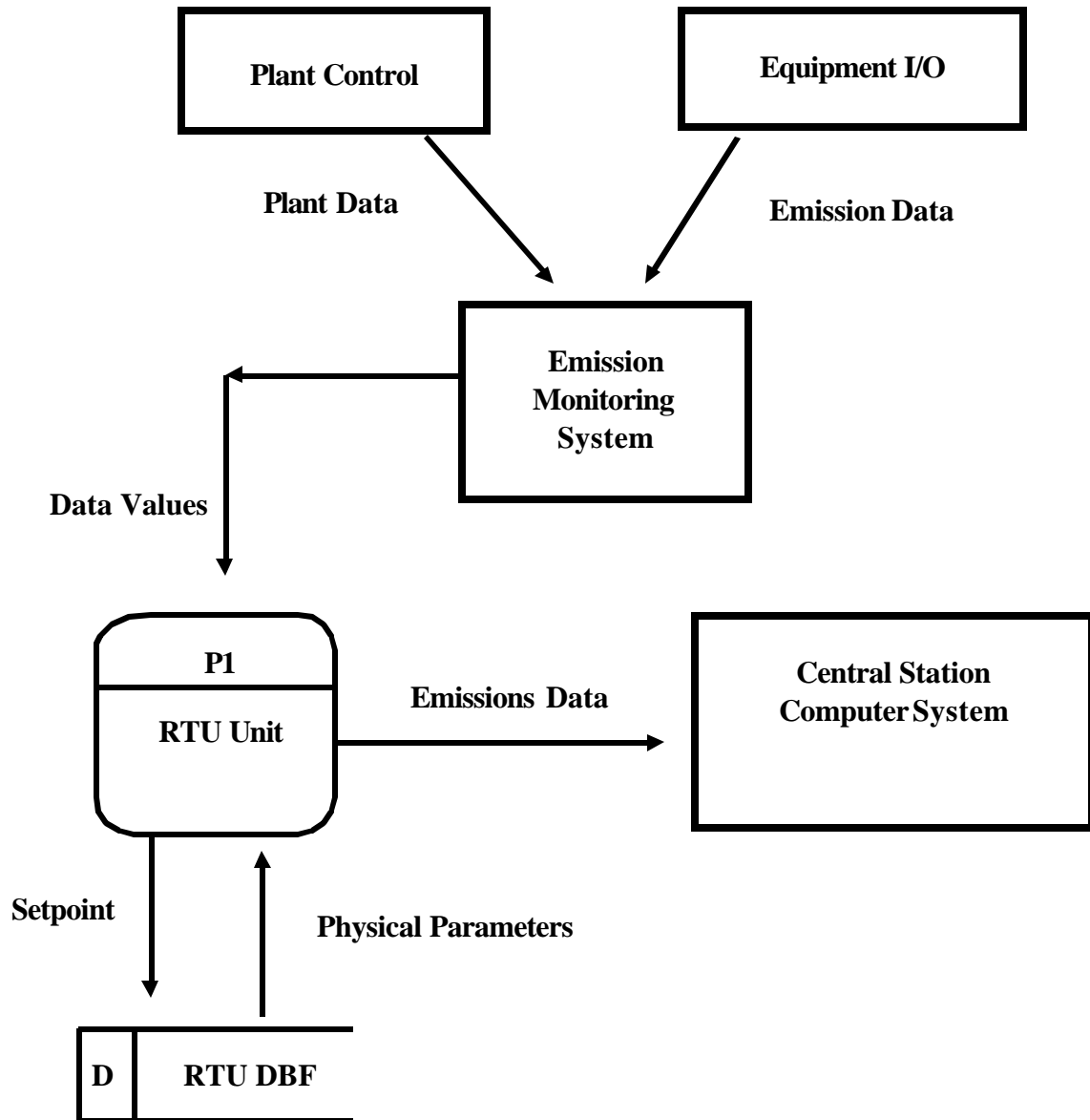
The Status Word Table is used to compile the status word for the required reporting period. True is 1 and False is 0.

Location	Field	Length	Description
1-1 period,	Valid Data	1	Enter true if valid data was obtained for the entire reporting period, else enter false
2-2 reporting	Calibration	1	Enter true if the monitoring system was calibrated during the period, else enter false
3-3 the	Off-line	1	Enter true if the monitoring system was off-line at any time during reporting period, else enter false.
4-4 reporting	Alternate Data Acquisition	1	Enter true if alternate data acquisition was used during the period, else enter false.
5-5 period,	Out of Control	1	Enter true if the CEMS was out of control during the reporting period, else enter false.
6-6 reporting	Fuel Switch	1	Enter true if more than one fuel type was used during the period, else enter false.

APPENDIX G

DIAGRAMS

### RTU Context Diagram



### RTU Data Flow Diagram

